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# A Safety Net for Hawaii's Rarest Plants

*T*he Hawaiian Islands are the most isolated high islands in the world, located over 2,000 miles (3,220 kilometers) from the nearest continental land mass. Their isolation, together with a high diversity of habitat types, makes the Hawaiian flora one of the most unique in the world. Approximately 1,500 plant species are indigenous to the Hawaiian Islands, and nearly 90 percent of these are found nowhere else. This represents one of the highest levels of endemism anywhere in the world.

The narrow geographic range of many native Hawaiian species makes them very susceptible to decline from a loss of habitat quantity and quality. A growing human population already has damaged or destroyed much of Hawaii's native plant habitat. The additional harmful effects of introduced plants and animals have driven many species even closer to the brink of extinction. So far, approximately 100 native Hawaiian plant species of historical times are no longer thought to exist in the wild, with only a handful saved in cultivation. Of the remaining 552 Hawaiian plant species that are rare, approximately 150 have fewer than 50 individuals remaining in the wild. These statistics are just a symptom of the larger problem of ecosystem decline that ultimately reduces ecological stability and jeopardizes the survival of unique island biota. Hawaii shares this pattern of decline and extinction with many island groups.

Until these threats can be managed, the status of endemic species in Hawaii will continue to decline and more species will become threatened with extinction. Habitat conservation and the control of harmful nonnative species are necessary for the survival and ultimate

recovery of Hawaii's native plants and animals. However, for many Hawaiian plants, these approaches will not be implemented quickly enough to prevent extinction. Immediate action must be taken before they are lost forever.

We have dubbed Hawaiian plant species that number fewer than 50 individuals the "Genetic Safety Net" (GSN) species of Hawaii. Currently, there are approximately 150 GSN species, although the numbers change rapidly as more individuals and/or populations are located and other populations disappear. We view emergency actions for these species as temporary but essential measures to prevent extinction until enough suitable habitats can be secured.

The Hawaii Rare Plant Restoration Group—a coalition of Center for Plant Conservation participating institutions, other botanical gardens, federal and state agencies, private organizations, and independent botanists—is developing a GSN program aimed at preventing the loss of Hawaii's most endangered plant species. The objectives are to 1) obtain comprehensive genetic samples of the surviving wild plant populations for the most critically endangered species in Hawaii; 2) store or cultivate samples collected from these plant species; 3) propagate every high priority species in sufficient numbers to maintain genetic diversity and provide stock for reintroduction into native habitat; 4) integrate *ex situ* (off site, or in cultivation) and *in situ* (on site, or in native habitat) conservation projects; and 5) produce an information management system that tracks the complex actions in the *ex situ* arena and disperses data promptly to involved stakeholders and *in situ* managers.

**(Opposite page) *Clermontia peleana* ssp. *peleana*, is extinct in the wild, but the only tree in cultivation flowered and fruited recently, raising hopes that viable seeds can be obtained for propagation and reintroduction into natural habitat.**

Photo by Thomas Lammers/University of Wisconsin-Oshkosh.



We are already making progress. Two field collectors from the National Tropical Botanic Garden (NTBG) on the island of Kaua'i are collaborating with partners from the Hawaii Rare Plant Restoration Group and private land owners to gather genetic representation of every individual of each of the GSN species throughout the islands. A pilot project to monitor a natural population, manage threats in a small area, and gain full genetic sampling of 33 of the GSN species is also underway on the island of O'ahu. Botanists will collect seeds and/or vegetative samples from every remaining individual from the small remnant populations covered under both projects in order to guarantee capturing all existing genetic variation. Detailed data are collected on phenology (time and amount of flowering and fruiting) and the immediate threats to identify needed management and provide data for future efforts.

The long-term storage options for the GSN propagation material are 1) *in vitro* storage of seeds, embryos, tissues in culture, or plantlets in media at University of Hawaii's Lyon Arboretum Micropropagation Lab, with a potential backup storage site; 2) conventional seed storage at the Lyon Arboretum and NTBG; and 3) cryogenic storage at the U.S. Department of Agriculture's National Seed Storage Laboratory in Fort Collins, Colorado. A recent inventory revealed that only about 50 percent of the approximately 150 species on the GSN list have been incorporated into the Lyon Arboretum's tissue culture lab or other storage facilities. The limitations to this form of storage include lack of space, the expense of repeated culturing, and the lack of knowledge of the mutations that may occur in long-term storage. Cryogenic storage is in the early research and development stage at the National Seed Storage Laboratory, but it promises to be a cost-effective method of long-term storage.

The GSN program invests in the three types of medium and short-term storage, typically used for the provision of

materials for reintroduction: 1) germplasm banks (for example, seed banks and *in vitro* storage), 2) living collections at botanical gardens, and 3) remote "field gene banks" housed in a network of small nurseries. Partnerships will be vital to the continued funding and operation of these storage facilities. The Volcano Rare Plant Facility on the Big Island is a shining example of what can be done on a very limited budget for dozens of endangered plant species. Currently, the Volcano Facility is growing thousands of Mauna Kea and Mauna Loa silverswords (*Argyroxiphium sandwicense* ssp. *sandwicense* and *A. kauense*) for reintroduction into the wild. In addition, the facility houses some of the rarest of Hawaii's endangered plant species, including the last known individual of *Clermontia peleana* ssp. *peleana*, a tree that is extinct in the wild.

Data management is a large component of the GSN program. The Hawaii Rare Plant Restoration Group is planning to develop a relational database manage-

ment system intended to 1) monitor all natural populations of critically endangered Hawaiian plant species, 2) track all genetic samples of rare plant species and populations, and 3) monitor the survivorship of reintroduced propagules generated by the *ex situ* facilities.

The concerted efforts of a partnership such as the Hawaii Rare Plant Restoration Group makes it possible to achieve the primary GSN objectives, which would be daunting for the Fish and Wildlife Service or a state agency to implement on their own. Full implementation of the GSN program will provide adequate storage options for genetic material, ensure the necessary management of living collections, and complete the network of nurseries needed to propagate and cultivate species for storage and reintroduction. Such a program allows us time to plan and undertake habitat protection programs and make appropriate material available for plant restoration and reintroduction.

#### **The member agencies of the Hawaii Rare Plant Restoration Group represent a broad range of agencies and organizations.**

Amy B.H. Greenwell Ethnobotanical Garden (CPC garden)  
Bernice P. Bishop Museum  
Center for Plant Conservation  
Harold L. Lyon Arboretum (CPC garden)  
Hawaii Natural Heritage Program  
Hawaiian Ecosystems at Risk project (USGS/BRD/PIERC/HFS/HEAR)  
Honolulu Botanical Garden (CPC garden)  
Kamehameha Schools/Bishop Estate  
Kokee Resource Conservation Program  
Maui Land & Pineapple Company  
Maui Nui Botanical Garden  
National Park Service  
National Tropical Botanical Garden (CPC garden)  
Secretariat for Conservation Biology  
Smithsonian Institution  
State of Hawaii DLNR, Division of Forestry and Wildlife  
The Nature Conservancy of Hawaii  
University of Hawaii  
U.S. Army Garrison Hawaii, Environmental Division  
U.S. Army, Pohakuloa Training Area  
U.S. Fish and Wildlife Service  
U.S. Forest Service  
Waimea Arboretum and Botanical Garden (CPC garden)

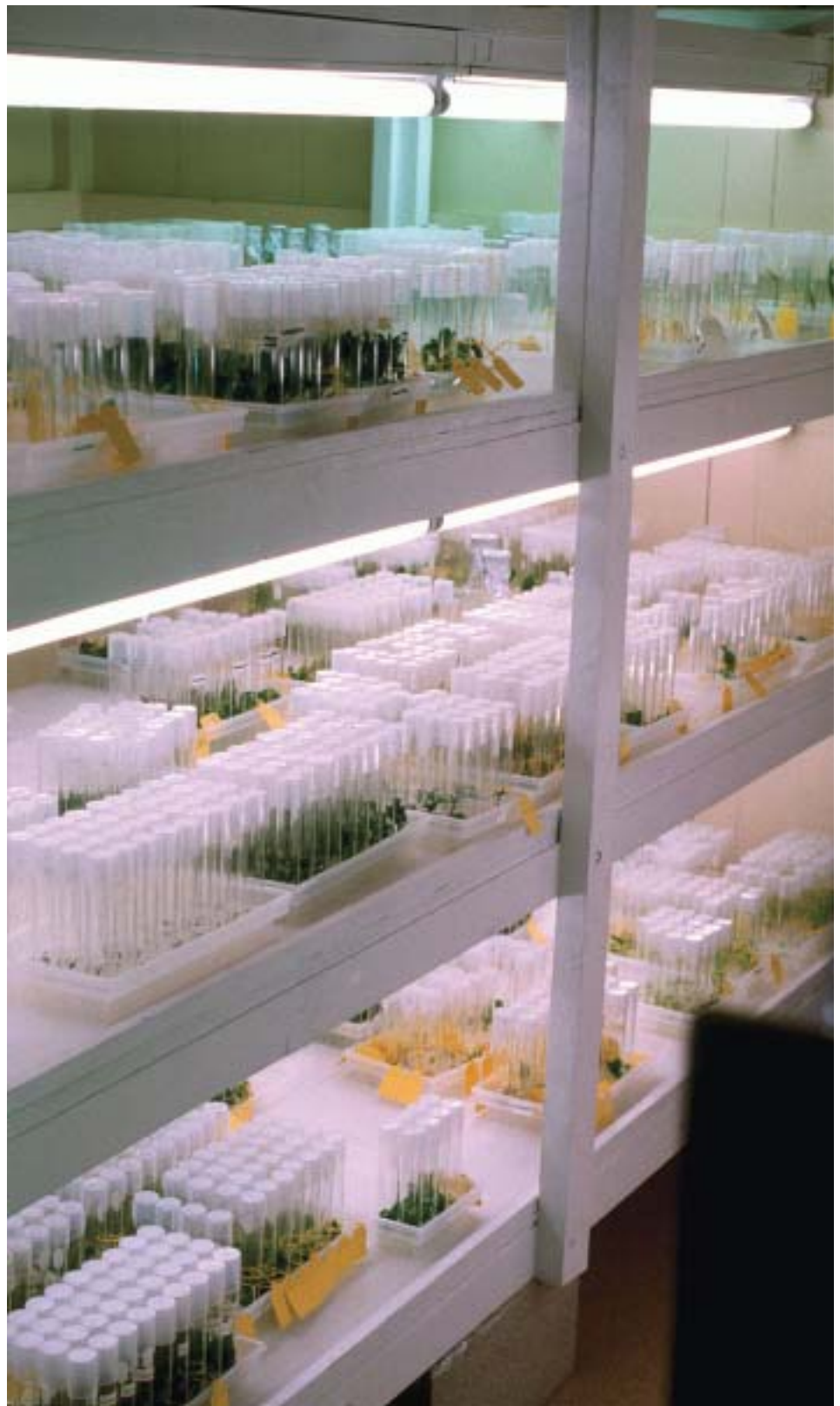


*In situ* and *ex situ* conservation efforts should proceed in combination to ensure that the habitat suitable for reintroduction has protection when the propagated plants are ready for reintroduction. Managers of protected habitats also need to be assured that the plants reintroduced on their lands will be of the highest quality (non-hybrid and disease free), represent conservation priorities, are from appropriate source populations, are species suitable for the habitats being managed, and are conducted as part of a species recovery plan. The cooperative efforts for the recovery of the Hawaiian silversword, as described in volumes 13(2-3), 23(4-5), and 25(3) of the *Endangered Species Bulletin*, are exactly what are needed for the numerous other endangered Hawaiian plants. The Service, state, and CPC, through the Service's Hawaii and Pacific Plant Recovery Coordinating Committee and with input from the Hawaii Rare Plant Restoration Group, are cooperating in the development of a plan for the recovery of all Hawaiian plants.

Without an intensive restoration and protection effort, a large proportion of the Hawaiian flora will not survive for long other than as seed samples or specimens in botanic gardens. Unfortunately, Hawaii's crisis is the future for many oceanic ecosystems. The lessons we learn in the salvage and, ultimately, the restoration of Hawaii plant species will be important to islands throughout the world.

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***Lyon Arboretum has more individuals of most GSN species than are growing in the wild. This is currently our most reliable medium-term storage method.***

*Photo by Greg Koob/U.S. Fish and Wildlife Service*